

FIG.1

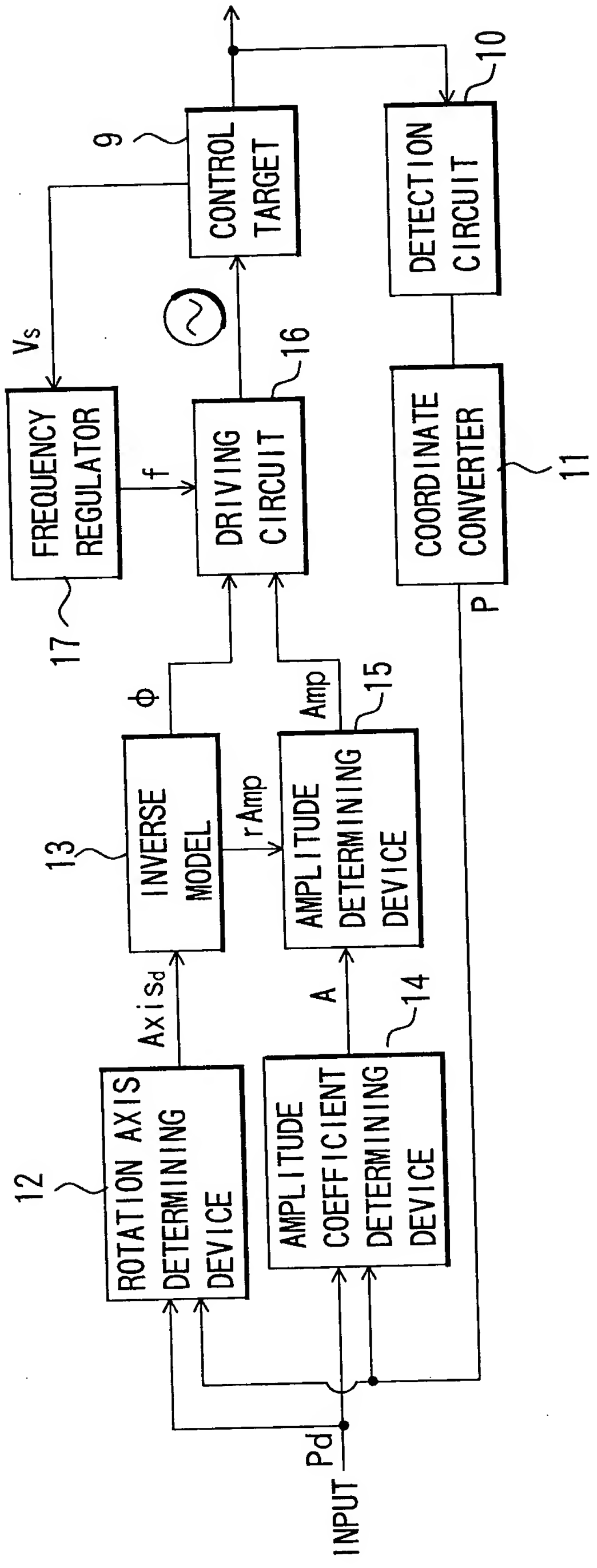


FIG.2

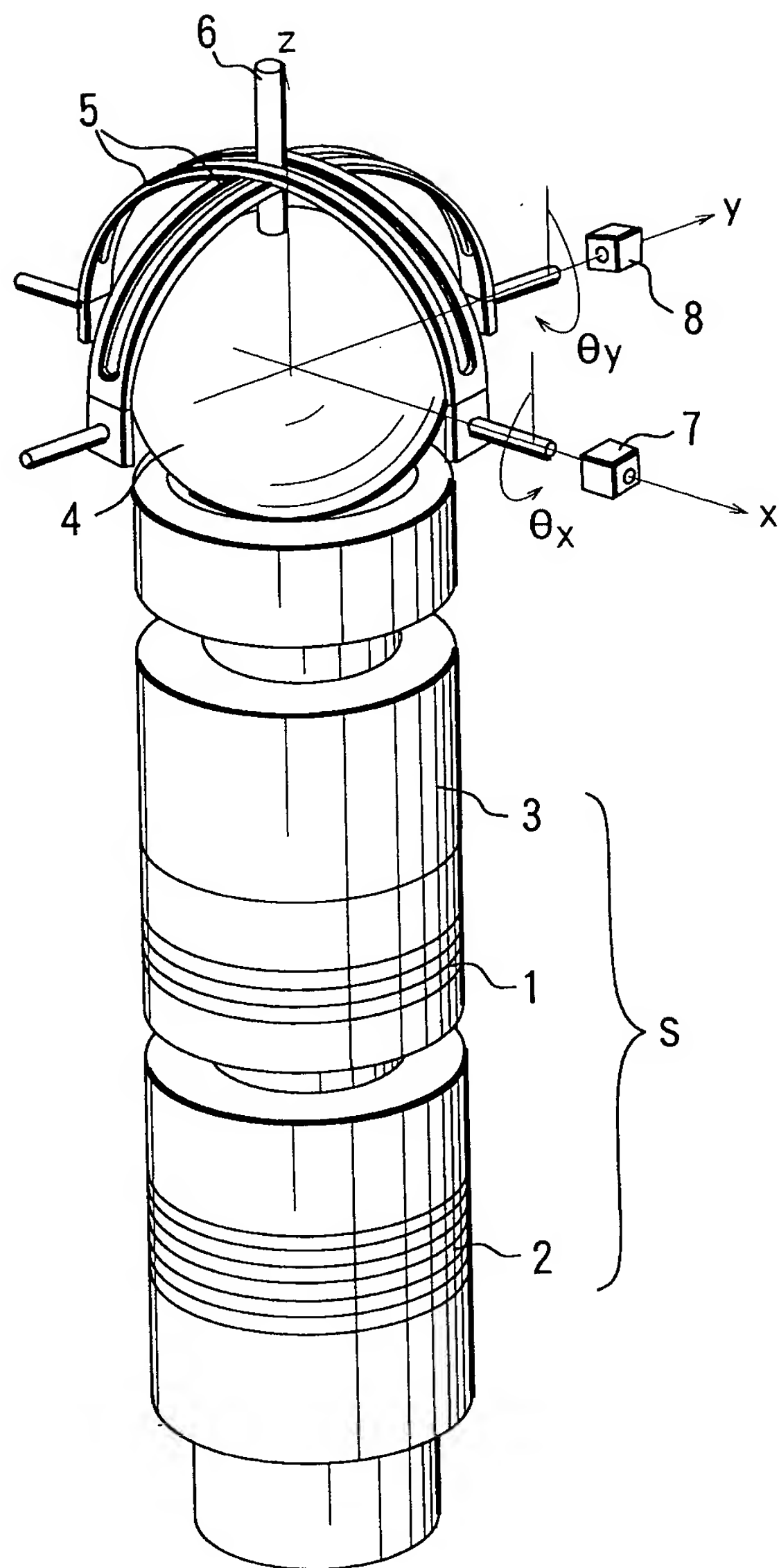


FIG.3

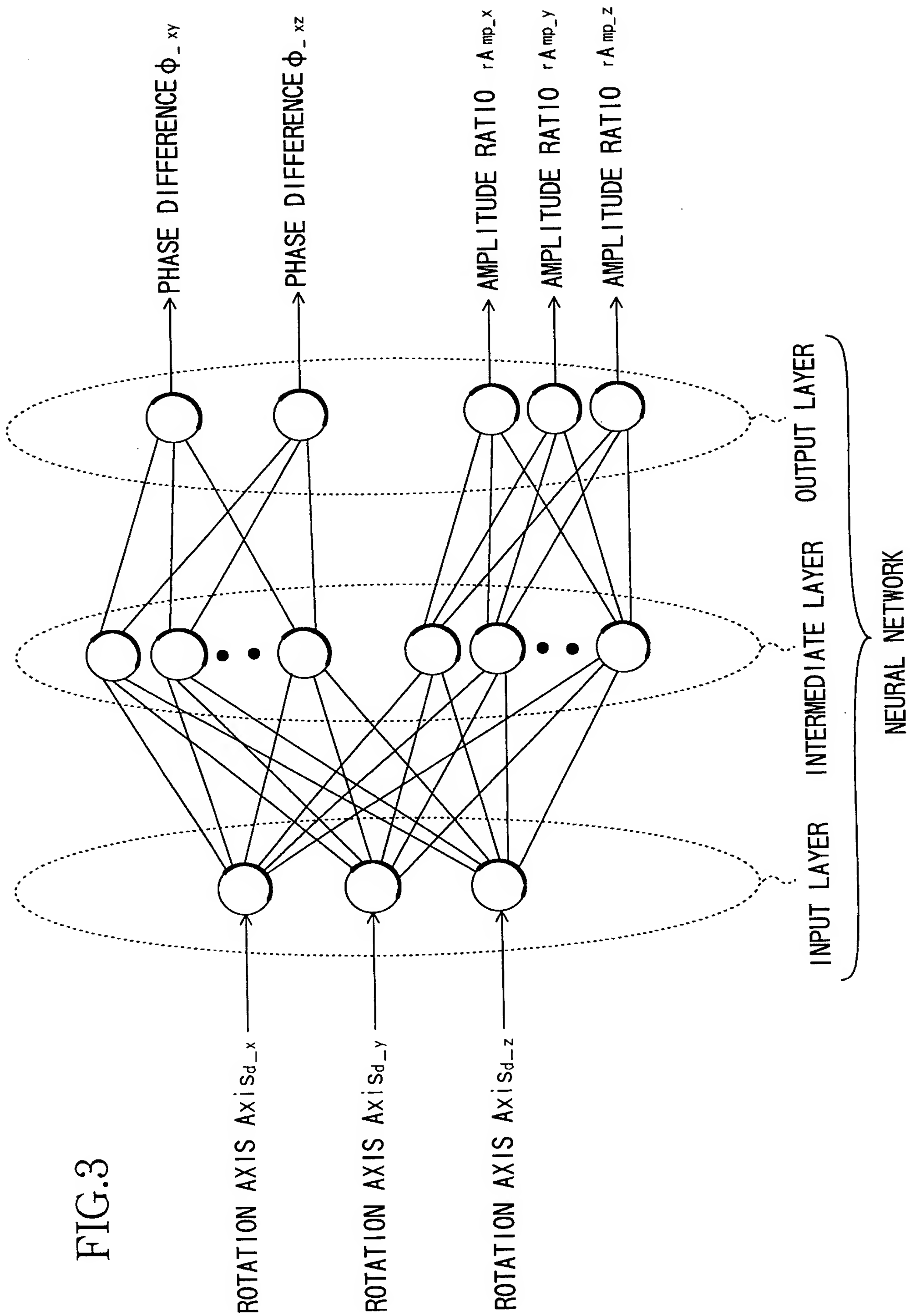


FIG.4

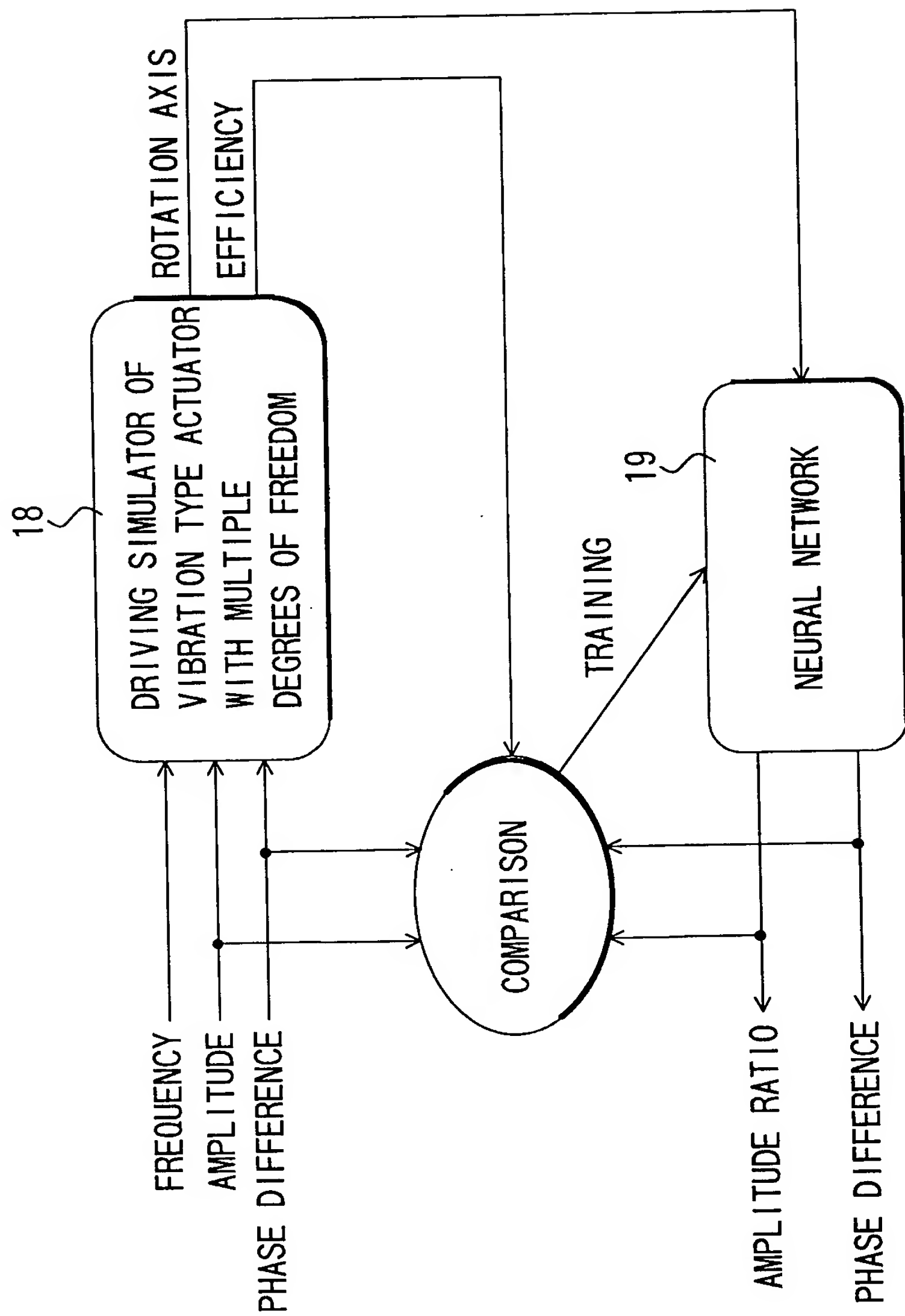


FIG.5

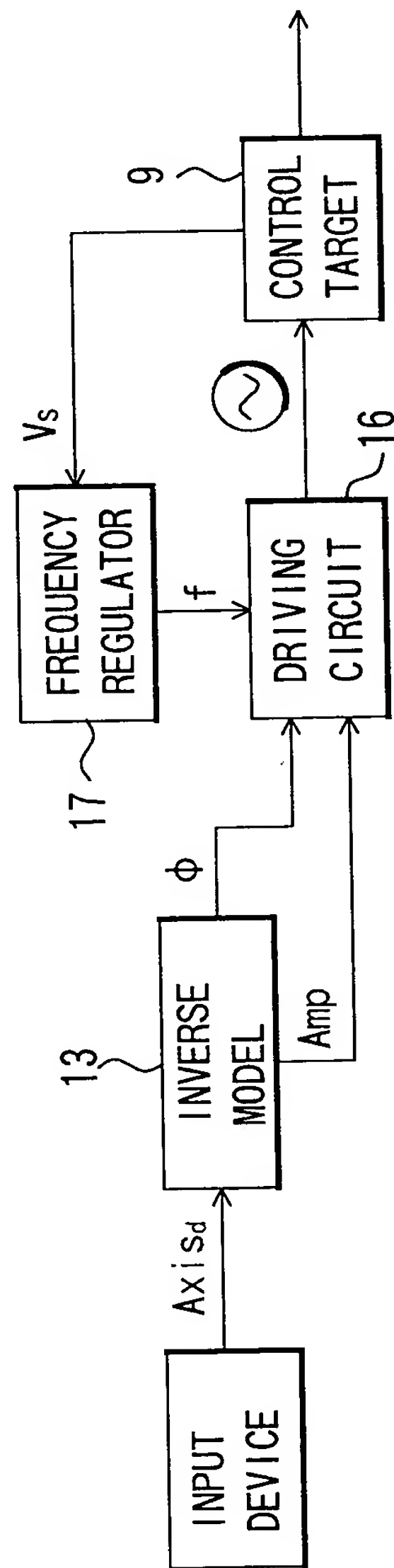


FIG.6

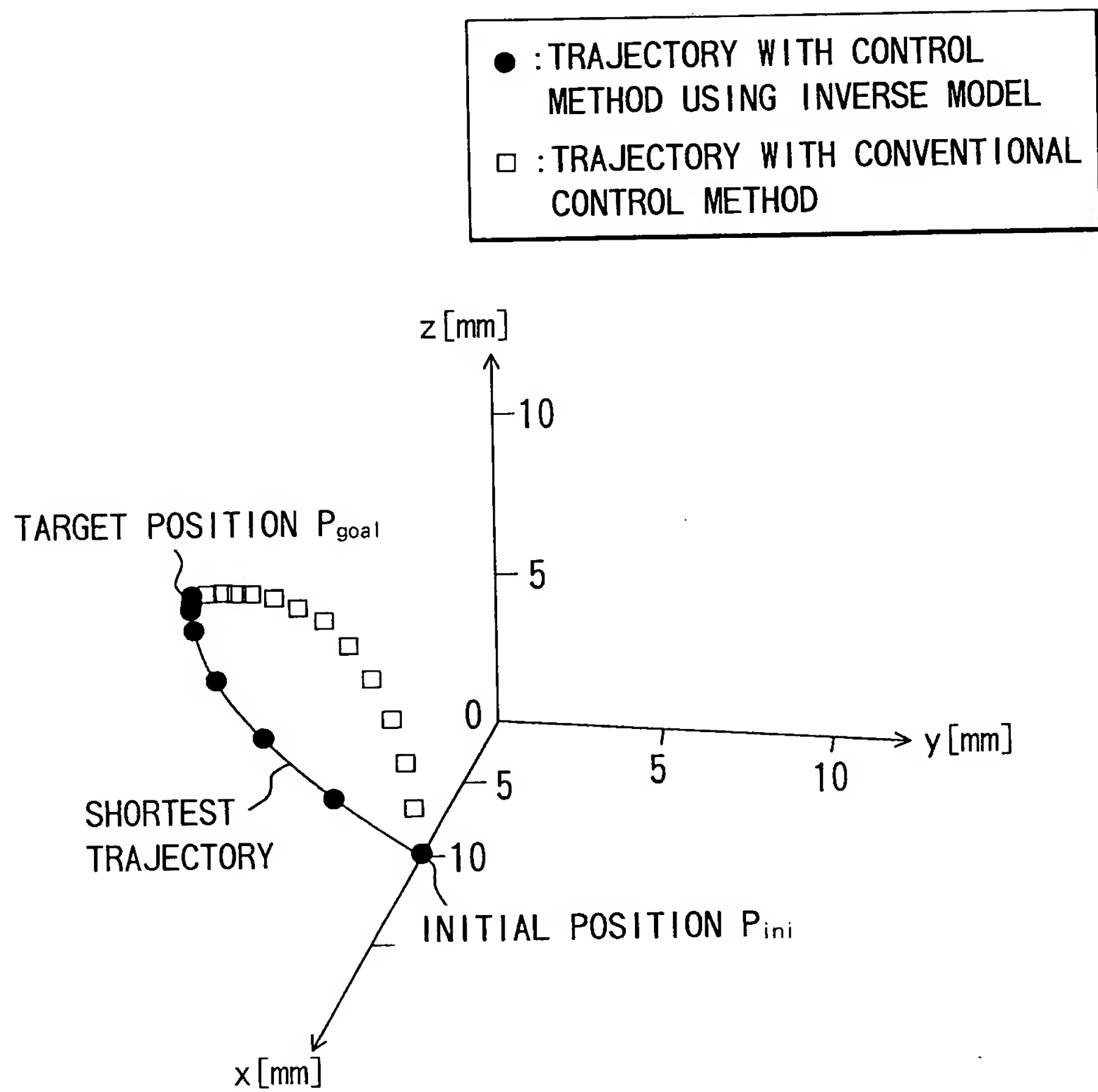
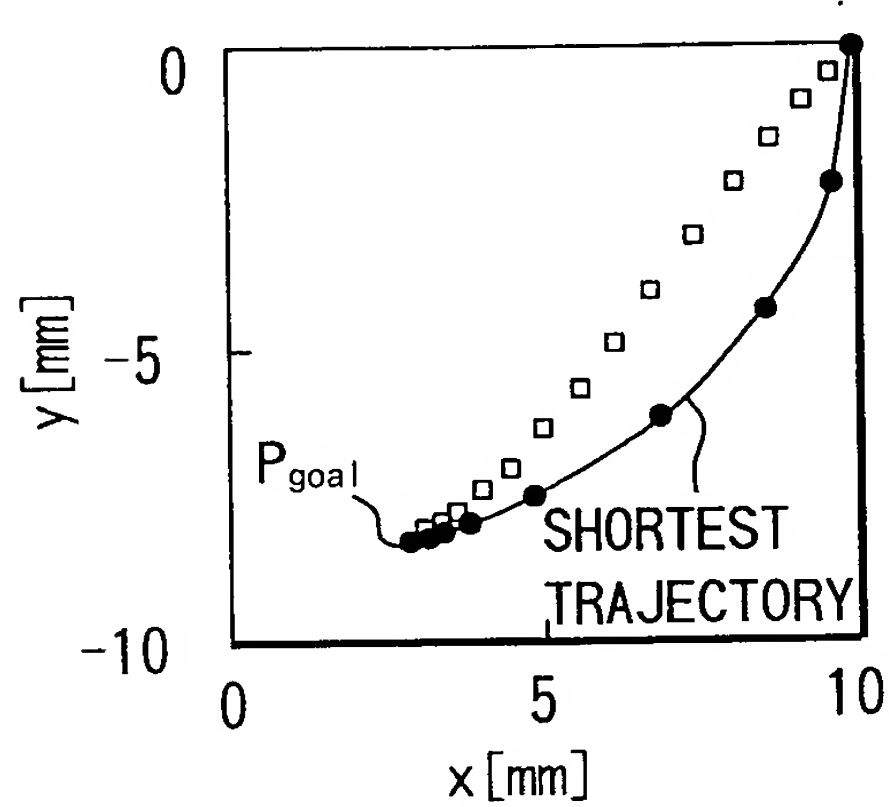
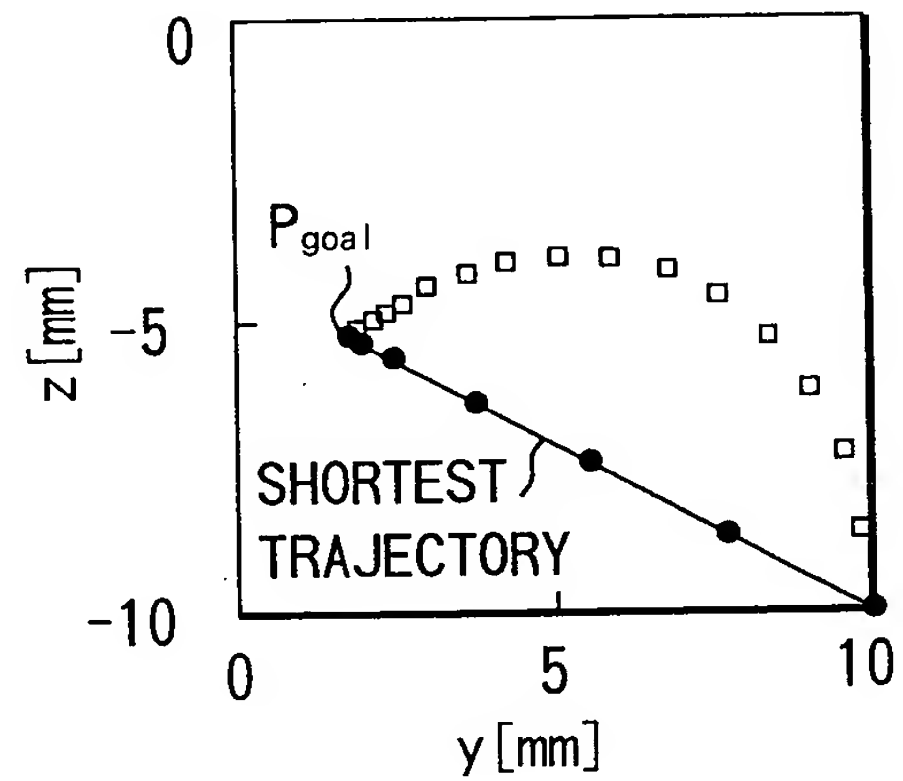


FIG.7 (A)



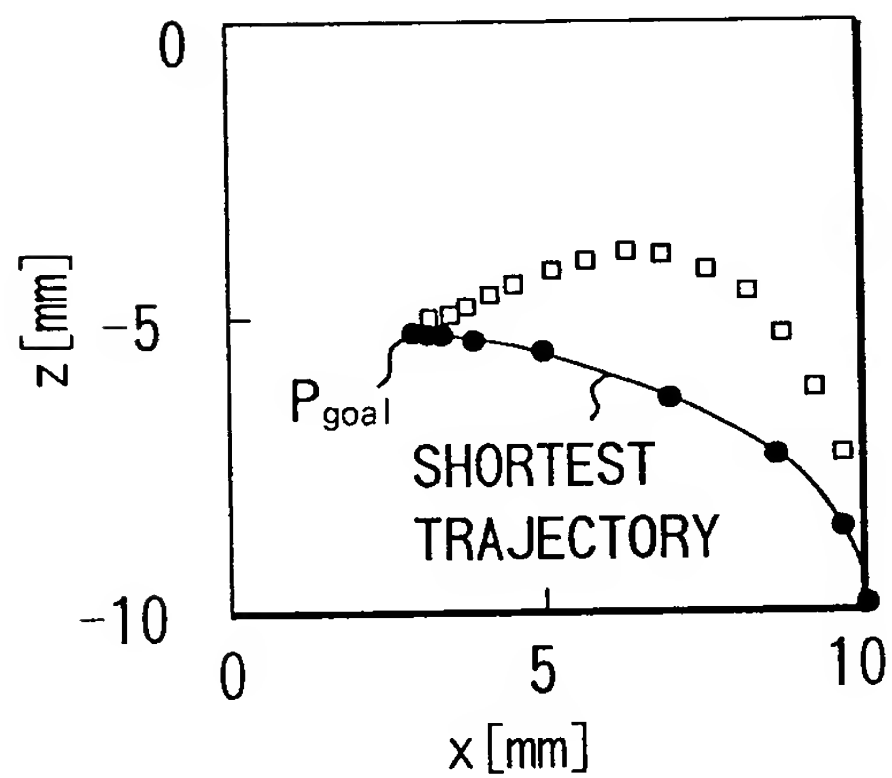
PROJECTION ONTO x-y PLANE

FIG.7 (B)



PROJECTION ONTO y-z PLANE

FIG.7 (C)



PROJECTION ONTO z-x PLANE

- : TRAJECTORY WITH CONTROL METHOD USING INVERSE MODEL
- : TRAJECTORY WITH CONVENTIONAL CONTROL METHOD

FIG.8

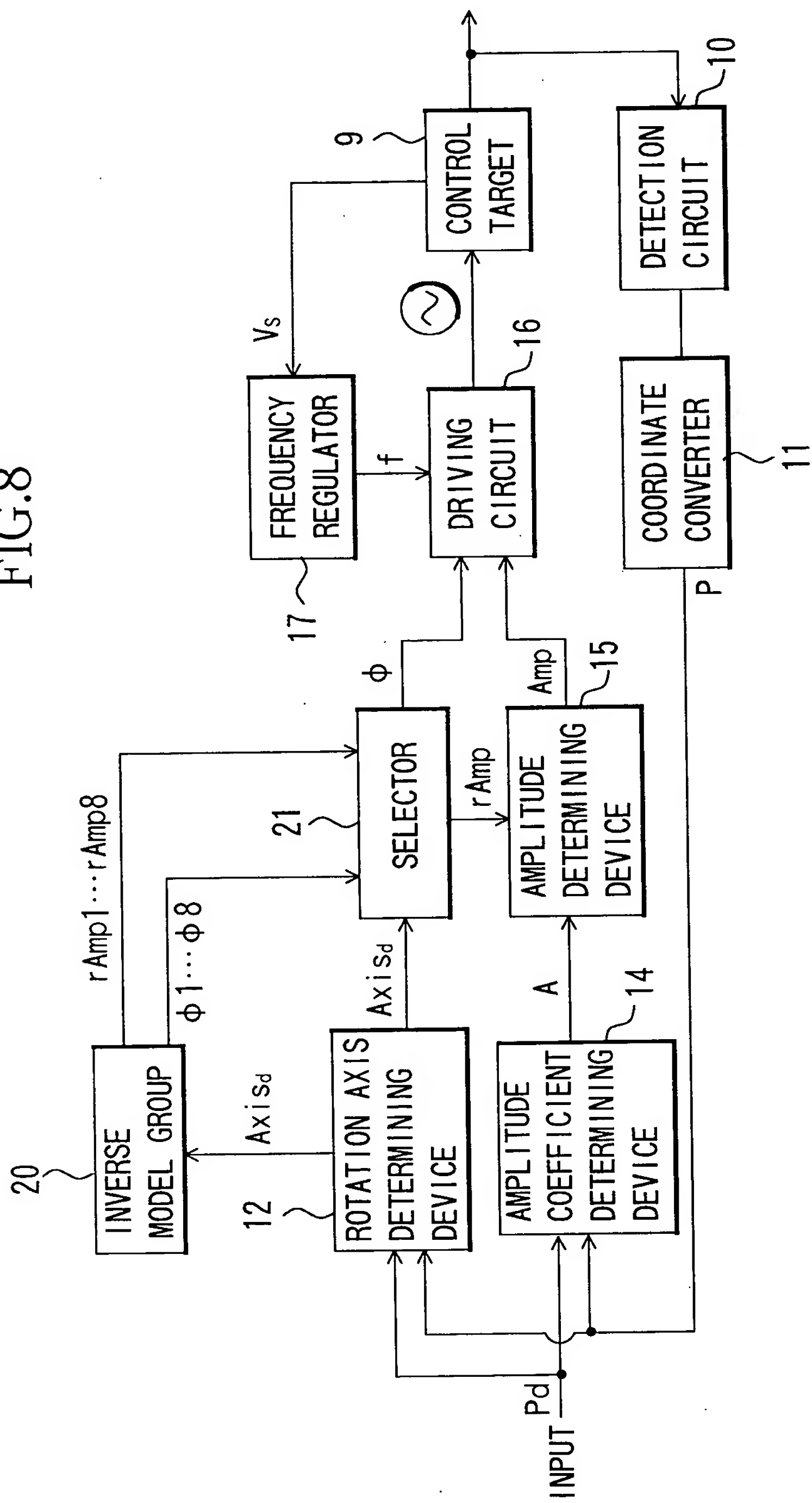


FIG.9

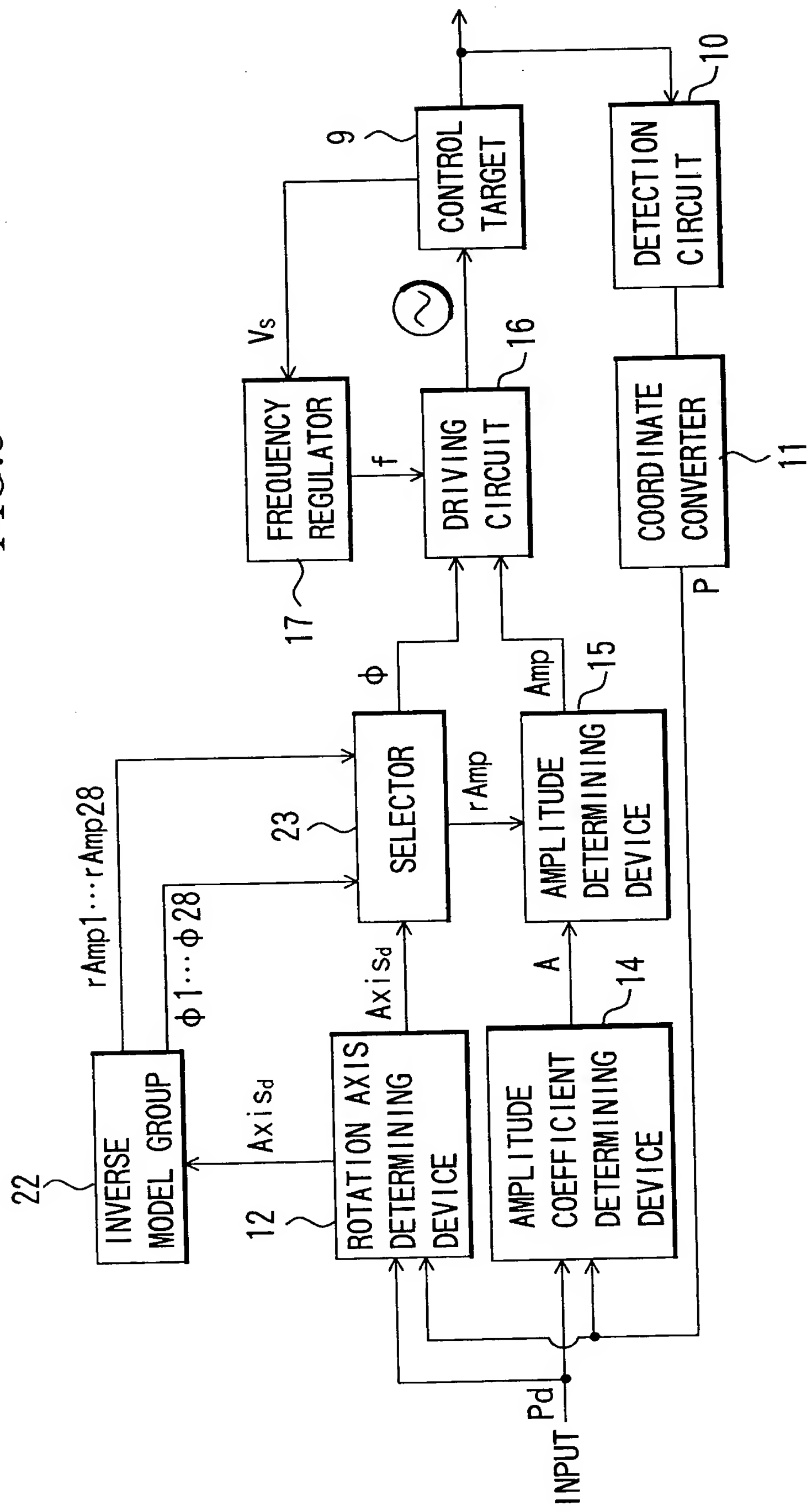


FIG.10

| SIGN OF x-COMPONENT | SIGN OF y-COMPONENT | PHASE DIFFERENCE ϕ_{xy} | PHASE DIFFERENCE ϕ_{xz} |
|------------------------|------------------------|---------------------------------|---------------------------------|
| + | + | π | $\pi/2$ |
| + | - | 0 | $-\pi/2$ |
| - | + | 0 | $\pi/2$ |
| - | - | π | $-\pi/2$ |

FIG.11

| STATE NUMBER | CLASS | SUB- CLASS | SIGN OF EACH COMPONENT OF ROTATION AXIS VECTOR | | PHASE ϕ [rad] | | | AMPLITUDE RATIO | | | | |
|-----------------|-------|---------------|---|---------------|--------------------|-------------|--|--|---|------------------|----------------------|----------------------|
| | | | | | ϕ_x | ϕ_y | ϕ_z | Amp _x | Amp _y | Amp _z | | |
| | | | x-AXIS | y-AXIS z-AXIS | | | | | | | | |
| 1 2 3 | 1 | 1 2 3 | + | + | - | x y z | $-\pi/2 \sim 0$ 0 0 | $\pi/2$ $\pi/2 \sim \pi$ $\pi/2$ | 0 $\pi/2$ $0 \sim \pi/2$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 4 5 6 | 2 | 1 2 3 | + | - | + | x y z | $\pi/2 \sim \pi$ $\pi/2$ $\pi/2$ | $\pi/2$ $0 \sim \pi/2$ 0 | 0 $-\pi/2 \sim 0$ $-\pi/2 \sim 0$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 7 8 9 | 3 | 1 2 3 | + | - | - | x y z | $0 \sim \pi/2$ $\pi/2$ 0 | $\pi/2$ $\pi/2 \sim \pi$ $\pi/2$ | 0 0 $-\pi/2 \sim 0$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 10 11 12 | 4 | 1 2 3 | - | + | + | x y z | $0 \sim \pi/2$ 0 $\pi/2$ | 0 $-\pi/2 \sim 0$ 0 | $\pi/2$ $\pi/2$ $\pi/2 \sim \pi$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 13 14 15 | 5 | 1 2 3 | - | + | - | x y z | $-\pi/2 \sim 0$ 0 0 | 0 $0 \sim \pi/2$ $\pi/2$ | $\pi/2$ $\pi/2$ $\pi/2 \sim \pi$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 16 17 18 | 6 | 1 2 3 | - | - | + | x y z | $\pi/2 \sim \pi$ $\pi/2$ $\pi/2$ | 0 $-\pi/2 \sim 0$ 0 | $\pi/2$ 0 $0 \sim \pi/2$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 19 20 21 | 7 | 1 2 3 | + | + | + | x y z | $-\pi \sim -\pi/2$ 0 $\pi/2$ | $\pi/2$ $-\pi \sim -\pi/2$ 0 | 0 $\pi/2$ $-\pi \sim -\pi/2$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |
| 22 23 24 | 8 | 1 2 3 | - | - | - | x y z | $\pi/2 \sim \pi$ 0 $-\pi/2$ | $-\pi/2$ $\pi/2 \sim \pi$ 0 | 0 $-\pi/2$ $\pi/2 \sim \pi$ | 1 1 1 | 1 $1 \sim 2$ 1 | 1 1 $1 \sim 2$ |

FIG.12

| STATE NUMBER | CLASS | SUB- CLASS | SIGN OF EACH COMPONENT OF ROTATION AXIS VECTOR | | COMPONENT WITH MAXIMUM ABSOLUTE VALUE | PHASE ϕ [rad] | | | AMPLITUDE RATIO rAmp | | |
|----------------------|-------|---------------|---|-------------------|---|---|--|---|----------------------|--------------------|------------------|
| | | | | | | ϕ_x | ϕ_y | ϕ_z | Amp_x | Amp_y | Amp_z |
| | | | x-AXIS | y-AXIS z-AXIS | | | | | | | |
| 1 2 3 | 1 | 1 2 3 | + | - | x y z | $-\pi/2 \sim 0$ 0 0 | $\pi/2$ $\pi/2 \sim \pi$ $\pi/2$ | 0 $\pi/2$ $0 \sim \pi/2$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 4 5 6 | 2 | 1 2 3 | + | + | x y z | $\pi/2 \sim \pi$ $\pi/2$ $\pi/2$ | $\pi/2$ $0 \sim \pi/2$ 0 | 0 0 $-\pi/2 \sim 0$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 7 8 9 | 3 | 1 2 3 | + | - | x y z | $0 \sim \pi/2$ $\pi/2$ 0 | $\pi/2$ $\pi/2 \sim \pi$ $\pi/2$ | 0 0 $-\pi/2 \sim 0$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 10 11 12 | 4 | 1 2 3 | - | + | x y z | $0 \sim \pi/2$ 0 $\pi/2$ | 0 $-\pi/2 \sim 0$ 0 | $\pi/2$ $\pi/2$ $\pi/2 \sim \pi$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 13 14 15 | 5 | 1 2 3 | - | - | x y z | $-\pi/2 \sim 0$ 0 0 | 0 $0 \sim \pi/2$ $\pi/2$ | $\pi/2$ $\pi/2$ $\pi/2 \sim \pi$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 16 17 18 | 6 | 1 2 3 | - | + | x y z | $\pi/2 \sim \pi$ $\pi/2$ $\pi/2$ | 0 $-\pi/2 \sim 0$ 0 | $\pi/2$ 0 $0 \sim \pi/2$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 19 20 21 | 7 | 1 2 3 | + | + | x y z | $-\pi \sim -\pi/2$ 0 $\pi/2$ | $\pi/2$ $-\pi \sim -\pi/2$ 0 | 0 $\pi/2$ $-\pi \sim -\pi/2$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 22 23 24 | 8 | 1 2 3 | - | - | x y z | $\pi/2 \sim \pi$ 0 $-\pi/2$ | $-\pi/2$ $\pi/2 \sim \pi$ 0 | 0 $-\pi/2$ $\pi/2 \sim \pi$ | 1~2 1 1 | 1 1~2 1 | 1 1 1~2 |
| 25 26 27 28 | | | +- 0 0 +- | 0 +- 0 0 | | 0 $0, \pi/2$ $0, \pi/2$ $0, \pi/2$ | $0, \pi/2$ 0 $\pi/2, 0$ $\pi, \pi/2, 0, 3\pi/2$ | $\pi/2, 0$ $\pi/2, 0$ 0 $\pi/2, 0, \pi/2, 0$ | 0 1 1 0~1 | 1 0 1 0~1 | 1 1 0 1 |

FIG.13

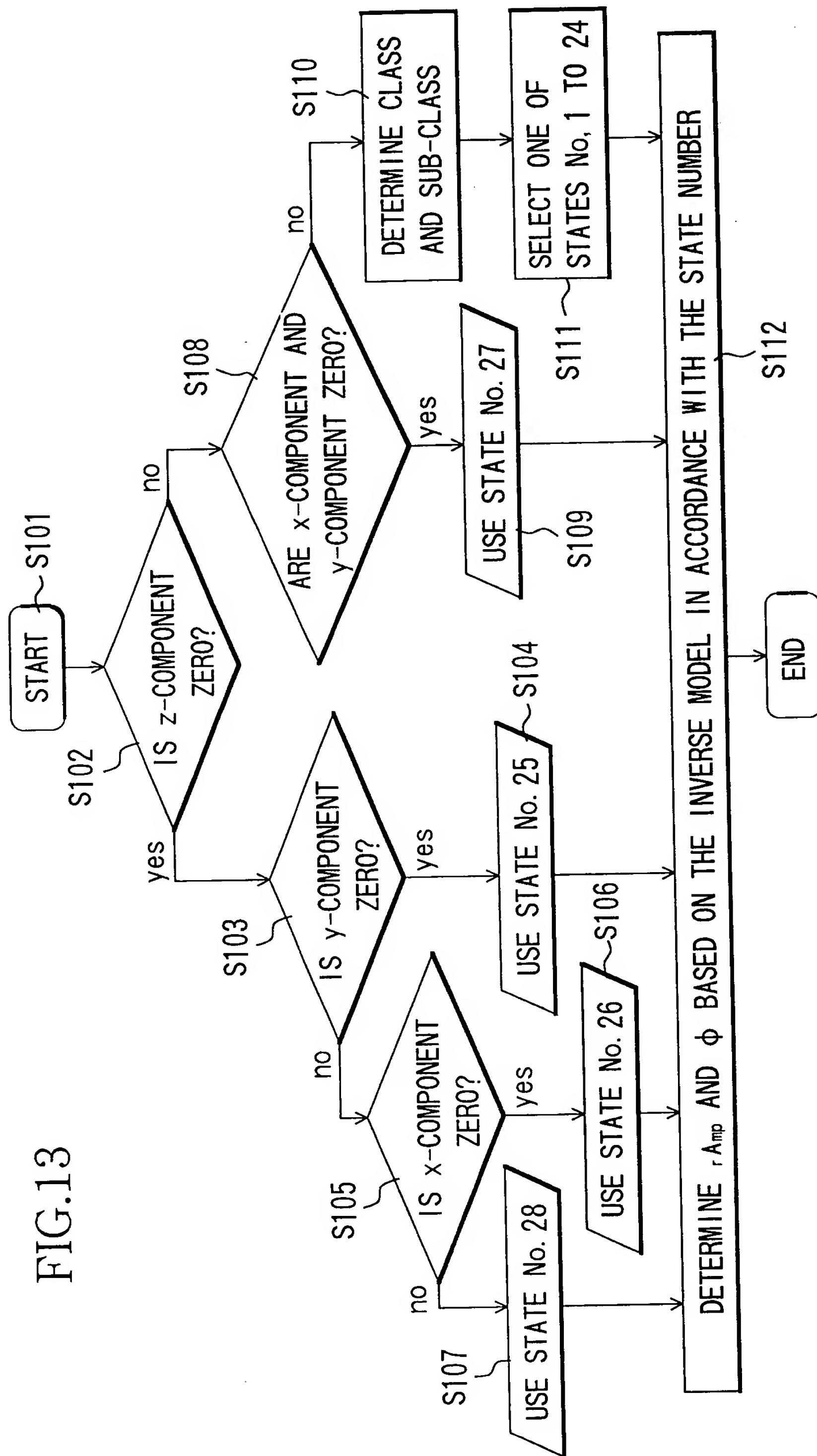


FIG.14

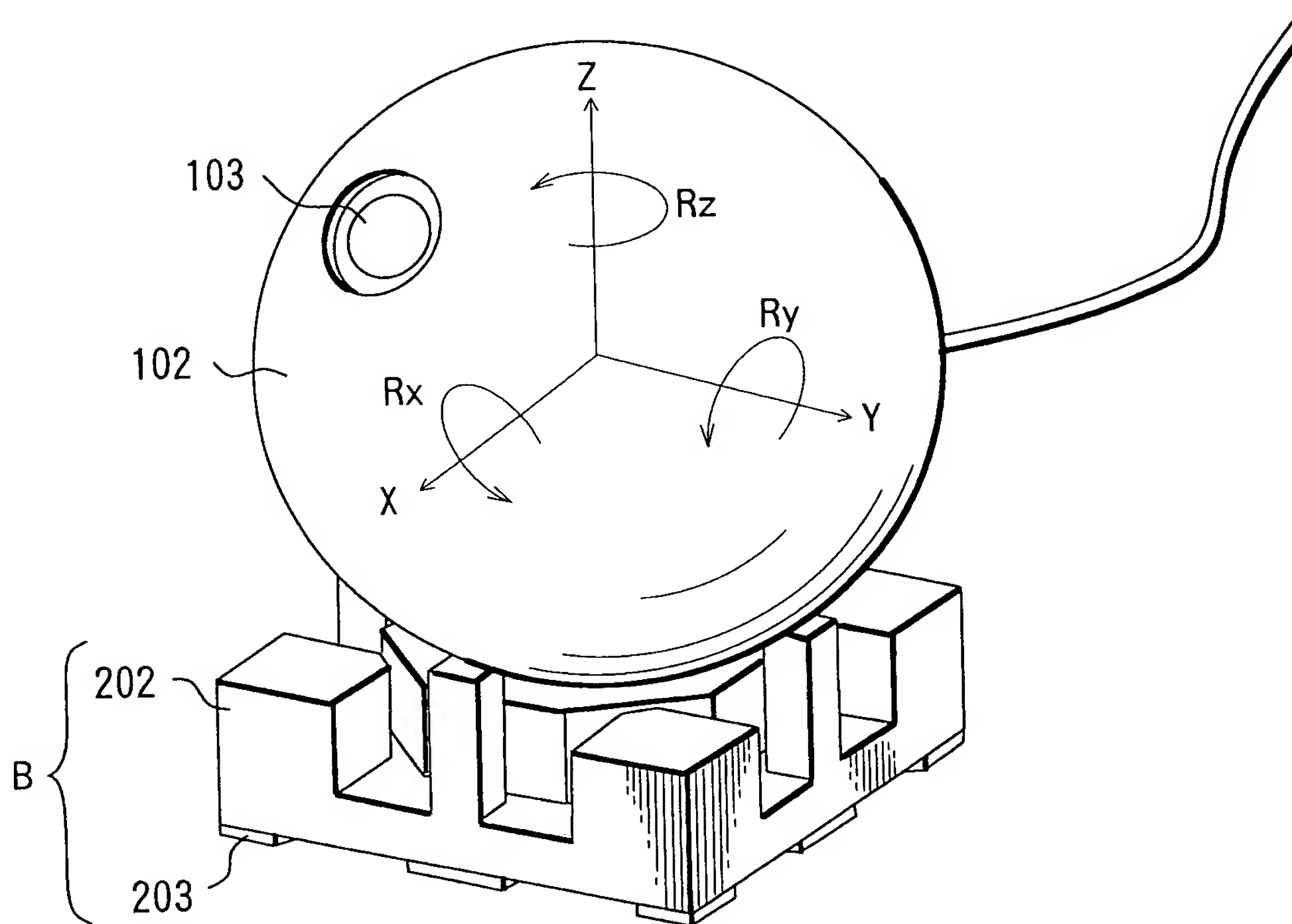


FIG.15

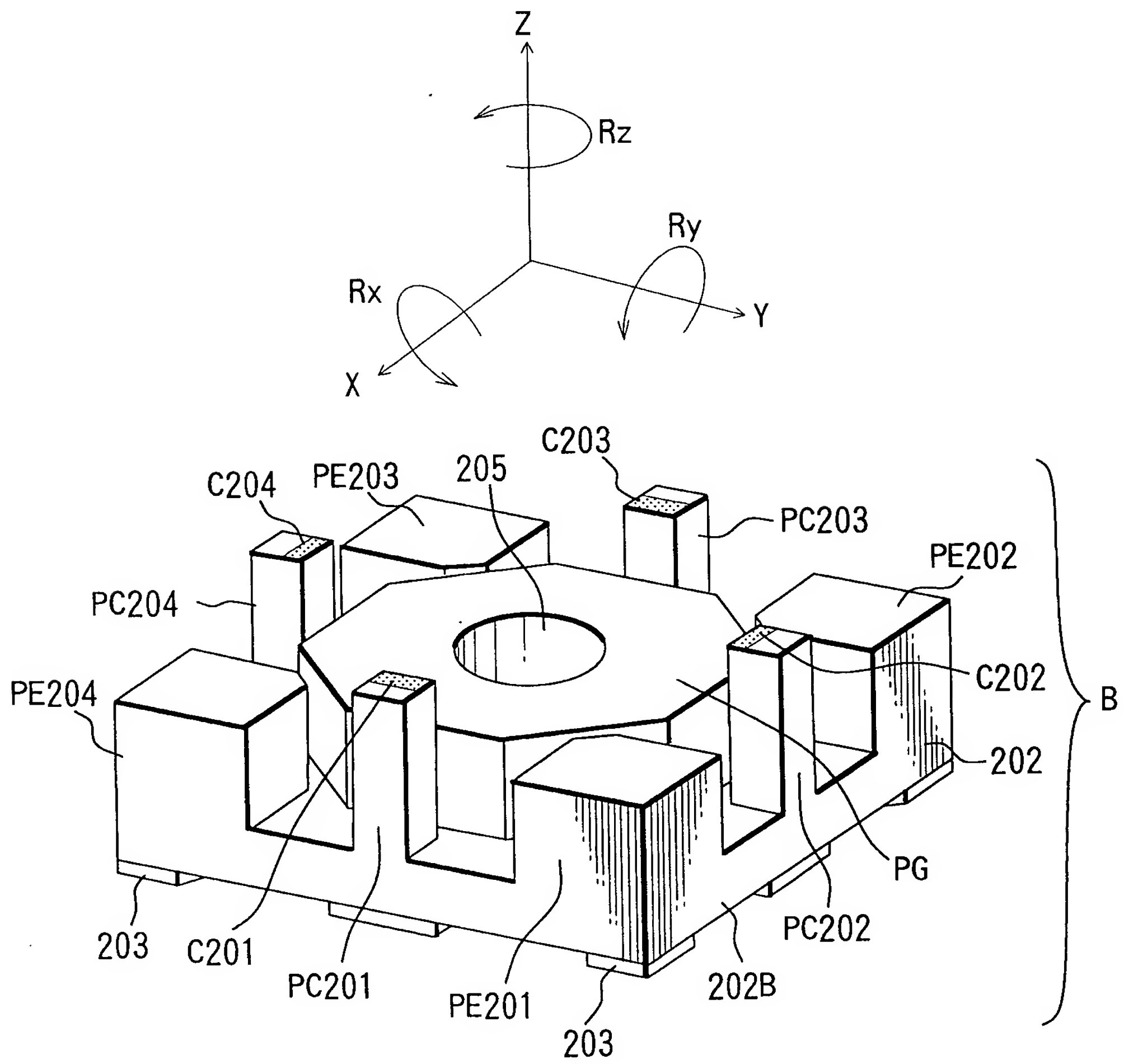


FIG.16

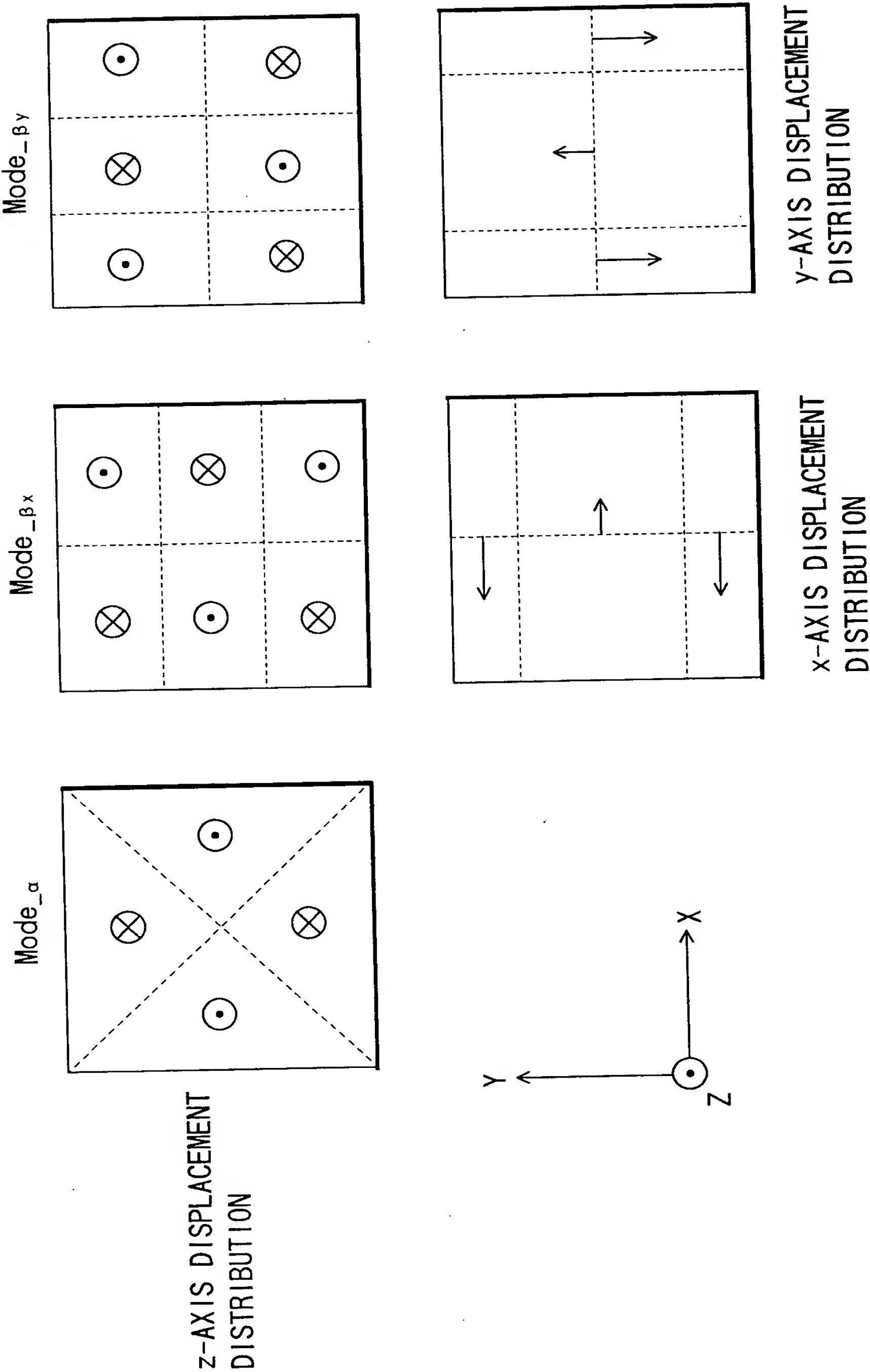


FIG.17

